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An investigation of factors affecting progress of patients on a stroke unit

N B LINCOLN, M BLACKBURN, S ELLIS, J JACKSON, J A EDMANS, F M NOURI, M F WALRER, H HAWORTH

From the Stroke Unit, General Hospital, Nottingham, UK

SUMMARY The aim of the study was to identify factors affecting the progress in physical abilities and activities of daily living of patients admitted to a stroke unit. A series of 70 patients admitted consecutively were assessed on a series of tests of motor, functional and cognitive abilities at admission. They were assessed for level of motor abilities and activities of daily living at discharge and 9 months after stroke. Predictive equations were developed which account for between 61% and 33% of the variance in motor abilities and activities of daily living at discharge and at 9 months after stroke. The most important factor influencing outcome was the degree of motor loss.

Studies on the prognosis of recovery from stroke have consistently shown certain factors to be associated with a poor functional outcome. For instance, Andrews *et al*[1] found perceptual problems to be associated with poorer mobility, dependence and mortality. Wade, Skilbeck and Langton-Hewer[2] found that incontinence, poor arm function, loss of sitting balance, hemianopia and old age were signs of a poor outcome in activities of daily living (ADL). Henley, Petit, Todd-Pokropek and Tupper[3] found that age, social contacts, functional abilities, cognitive abilities, mood and motivation together predicted outcome in terms of independent living. Feigenson, McDowell, Meese *et al*[4] using a multiple regression analysis reported that adequate perceptual function, cognitive function and motivation are the only strong predictors of whether or not patients were able to return home. The generality of these findings depends on the method of patient selection and the effectiveness of treatment procedures used. Such prognostic indices may not apply in settings with a different selection of patients or a different treatment regimen. The studies by Andrews and Wade were carried out on unselected groups of patients who were not all admitted to hospital. The study by Henley *et al*[3] was carried out on stroke patients admitted to a general hospital. In addition, to be useful to clinicians such prognostic indicators need to be easily assessable on standardised assessments which are published or readily available. The assessments need to have been shown to be reliable when given by different assessors.

Address for reprint requests: Dr N B Lincoln, Stroke Unit, General Hospital, Nottingham NG1 6HA, UK.

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In order to identify factors associated with poor prognosis in another rehabilitation setting, the information should be collected for that setting. This study was designed to identify factors associated with a poor prognosis for patients admitted to a specialist stroke unit at Nottingham General Hospital, using assessments which could be applied in other units.

Method

Patients were admitted to the Stroke Unit when they had recovered from the acute stage and were in need of rehabilitation but did not require acute medical care. Patients are referred to the Stroke Unit by general medical wards throughout the Nottingham district. The patients are assessed by the consultant and senior registrar attached to the unit; those needing acute medical care, those who are unfit for intensive rehabilitation and those patients with mild disability judged likely to return home within two weeks of the time of referral are not accepted. Within the group of patients accepted there is therefore a bias towards relatively severely disabled patients who are nevertheless able to cope with intensive rehabilitation. Nearly all patients referred are accepted and those that are rejected because they are too dependent on nursing or too medically ill are reviewed on the ward and are often taken to the Stroke Unit at a later date. This matching of referral and available places on the Stroke Unit is surprising considering the small number of places available. During the first week after admission each patient was assessed on the following:

(1) Rivermead Motor Function Assessment.[5] This is subdivided into three scales: Gross Function, Leg and Trunk, and Arm.

(2) Activities of Daily Living Scale[6]—a 10 point scale including feeding, washing and dressing.

(3) Perceptual abilities—Rivermead Perceptual Assessment Battery,[7] subtests—Right Left Copy Shapes and Cancellation, Rey figure copy[8] and Block Design subtest of Wechsler Adult Intelligence Scale.[9]

(4) Language abilities—Western Aphasia Battery,[10]—aphasia quotient and reading and writing quotient.
(5) Memory function—Logical Memory, subtest of Wechsler Memory Scale,[11] immediate recall and half hour delay, and Recognition Memory Test Faces.[12]
(6) Level of cognitive functioning National Adult Reading Test (NART)[13] and Coloured Progressive Matrices.[14]
(7) Incontinence rating—for continence of urine by day on a 7 point scale devised for the study. This is scored as: catheterised or condom = 0, incontinent = 1, incontinent despite regular toileting = 2, occasionally incontinent = 3, continent if toileted regularly = 4, continent except for accidents (e.g. bottle leaks) = 5, continent = 6.

In addition age, sex, marital status (scored at married = 0 not married = 1), side of stroke and weeks post onset were recorded.

At discharge the following were recorded:
(1) Number of days on the Unit,
(2) Gross function on the Rivermead Motor Function Assessment,
(3) ADL status on the 10 point scale,
(4) Place of discharge (Home, Hospital, Died or Other Accommodation).

Patients were reviewed 9 months after stroke and assessed on:
(1) Gross Function Scale of the Rivermead Motor Function Assessment.
(2) The 10-point ADL scale. An extended ADL scale[15] was also used to assess social and domestic activities which would not have been applicable whilst patients were in hospital.

Results

Patients

Between October 1985 and April 1986 there were 70 patients admitted to the Stroke Unit. Their ages ranged from 36 to 88 years (mean 62·8 SD 10·6 years) and 40 were men. They were admitted 1 to 13 weeks after onset (mean 3·6 SD 2·8 weeks), 73% were within a month of their stroke. There were 35 patients with right hemisphere lesions, 33 with left hemisphere lesions and one brainstem lesion and this information was missing for one patient.

Most patients were married (60%), the remainder being single (14%), widowed (14%), or divorced or separated (5%). For 54 patients (77%) this was their first stroke. About half the patients had speech problems (dysarthria 21%, dysphasia 31%). Most patients had some degree of hemiplegia in arm (weak 43% or no movement 54%) and leg (weak 73% no movement 23%). There were 25 (36%) with obvious perceptual deficits on initial clinical assessment, 14 (20%) with visual inattention, 13 (19%) with hemianopia and seven (10%) with swallowing difficulties. There were five with restricted vision, that is not able to read large print and five (7%) who had hearing impairment though could hear with an aid or shouting. At the end of the first week most patients (80%) were continent of faeces and 67% were continent of urine apart from occasional accidents. The average time spent on the Unit was 68 days (range 11 to 168 days) and 76% were discharged home.

Table 1 *Predictive Equations from stepwise multiple regression analyses*

Discharge dependent variable	*Admission predictor variables*	*B**	*Added variance*
Days on Unit	Gross function	−8·60	32%
	Marital status	−23·52	6%
	Constant	115·10	
Gross function	Gross function	0·69	52%
	Coloured Progressive Matrices	0·08	5%
	Constant	3·34	
ADL score	Gross function	0·54	30%
	Coloured Progressive Matrices	0·09	6%
	Constant	3·27	

*B – Weighting of variable for the generation of the predictive equation.

There were 54 patients reassessed at 9 months after stroke. Of those not assessed, five had died, three refused reassessment, one could not be traced, one had emigrated and six failed to attend for their appointment. The 54 patients who were reassessed were 36 to 88 years (mean 62·7, SD 10·1 years) and 29 were men. There were 29 with right hemisphere lesions, 23 with left hemisphere lesions, one brainstem lesion and one for whom this information was missing. At the 9 month follow-up, 38 patients were living at home, three in sheltered, six in nursing homes, two in other hospital wards and five in accommodation other than

Table 2 *Summary of discriminant function analysis for place of discharge*

	Canonical discriminant function coefficients	
Admission predictor variable	*Unstandardised**	*Standardised*
Marital Status	2·63	1·13
Arm Function	−0·03	−0·76
Right Left Copy Shapes	−0·02	−0·72
Cancellation	0·03	0·62
Logical Memory	−0·03	−1·07
Delayed Logical Memory	0·02	0·82
Age	0·03	0·29
ADL Score	0·17	0·32
Constant	−2·21	

	Actual Group	
Predicted Group	Home n = 51	Not Home n = 7
Home	43 84%	5 29%
Not Home	8 16%	12 71%

Cases correctly classified = 55 (81%)

*Unstandardised coefficients are used to calculate the discriminant function equation.

Table 3 *Predictive equations from stepwise multiple regression analysis*

Follow-Up	*Admission*		
Dependent Variable	Predictor variable	B	Added variance
Gross Function	Recognition Memory Faces	0·08	20%
	Incontinence	0·75	9%
	Constant	0·005	
ADL Score	Recognition Memory Faces	0·06	33%
	Right Left Copy Shapes	0·03	6%
	Incontinence	0·42	5%
	Constant	1·98	
Extended ADL			
Mobility	Recognition Memory Faces	0·12	23%
	Age	−0·28	15%
	Leg and Trunk	0·55	6%
	Delayed Logical Memory	−0·07	5%
	Reading and Writing	0·03	7%
	Constant	17·39	
Kitchen	Reading and Writing	0·03	16%
	Delayed Logical Memory	−0·05	7%
	Coloured Progressive Matrices	0·23	7%
	Cancellation	−0·11	5%
	Right Left Copy Shapes	0·06	5%
	Constant	2·85	
Domestic	Coloured Matrices	0·14	17%
	Cancellation	−0·12	12%
	Right Left Copy Shapes	0·05	10%
	Recognition Memory Faces	0·08	6%
	Constant	0·77	
Leisure	Reading and Writing	0·02	34%
	Age	−0·10	5%
	Right Left Copy Shapes	0·04	5%
	Constant	7·53	

their own home, for example with relatives. Of the 38 at home, ten were on their own. Only 15 of the patients (28%) were independent with the support of their spouse and an additional ten (19%) relied only on support from family or friends. All others (53%) were dependent on help from health or social services.

Factors affecting progress on the Stroke Unit

Stepwise multiple-regression analyses were carried out with days on the Unit, motor function at discharge and ADL on discharge as the dependent variables. This was to assess the proportion of the variance that could be accounted for by the abilities assessed. Variables were only included which had a probability of F less than 0·05. These are summarised in table 1. This shows that initial level of motor function accounted for the largest proportion of the variance on all three outcome measures.

A discriminant function analysis was then carried out to determine whether the assessments at admission could predict which patients were discharged to their own homes. Results are shown in table 2. Variables were only included which had an F value of 1·0. The formula obtained correctly classified 81% of patients.

Stepwise multiple regression analyses were carried out with gross motor function, 10 point ADL and extended ADL scores at 9 months as dependent variables. These are summarised in table 3.

Recognition memory was the variable which accounted for most variance in all the equations. Incontinence was predictive of physical abilities and ADL. Perception, memory and reading and writing were important determinants of independence as assessed on the extended ADL scale. Age was also predictive of mobility and leisure activities.

Discussion

Motor function was the single most important determinant of physical function and independence in activities of daily living at the time of discharge from hospital. The Coloured Matrices, which is a general measure of overall cognitive function, was the only other variable to have a significant predictive contribution to physical recovery. However, for predicting the time on the unit, cognitive abilities were not important and the patient's marital status was more important. Our results therefore have indicated a greater importance of motor function than previous studies.[3,4] We have also failed to support some suggestions that perceptual deficits have particular importance for recovery of independence in activities of daily living.[16,17] One reason for these discrepancies is that all measures used are general indices of overall stroke severity. In our study we used a relatively detailed scale of motor function with a possible range of 13 points. In contrast Fullerton *et al*[17] used a less sensitive scale of motor ability (6 point) and a more sensitive test of perceptual dysfunction. These differences in sensitivity of scales to overall stroke severity may account for differences in the items included in the predictive index.

Cognitive and social variables were more important in determining the place of discharge. This would suggest that for the same level of physical independence patients need better cognitive abilities to cope at home especially if they are elderly or living alone.

Visual memory as assessed on the Recognition Memory Test-Faces, was predictive of physical abilities and ADL scores nine months after the stroke. This has not previously been reported, but memory is rarely assessed in studies of stroke patients. Until recently most visual memory assessments have required patients to draw, making them inappropriate

for many hemiplegic stroke patients. The relationship between perceptual abilities and ADL has been well documented, though its importance in our study is less than has been reported by others.[16 17]

Motor function was less predictive of physical abilities and activities of daily living nine months after stroke than at the time of discharge. Possibly by this stage patients have adapted to their difficulties and have found ways of being independent even if they were not necessarily by the means recommended in hospital. Those with good cognitive function may make this adaptation more easily. Similarly cognitive factors seem more important as predictors of domestic and leisure activities, as these demand greater coping ability in the presence of impaired motor function than the physical activities assessed at discharge.

Multiple regression analyses provide predictive equations for recovery, which require further validation. Our equations support previous studies indicating that incontinence and motor function are important determinants of outcome and generally those patients with more severe strokes do less well. The number of days spent on unit can less readily be predicted because discharges are not always on the basis of functional recovery. Some patients may be discharged earlier than would be expected because of depression, family circumstances or unrelated medical conditions. However, having a spouse is a very important determinant. The proportion of variance accounted for by the various equations is only moderate (that is, between 29% and 57%) but does give a basis on which a clinical decision may be made. These equations are being validated on another series of stroke patients admitted to the same unit.

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